

Professional Development for Students and Post-docs at National Science Foundation Science and Technology Centers

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Overview. As the career landscape changes and the number of PhDs greatly outpaces the number of faculty positions (Cyranoski 2011; Schillebeeckx et al. 2013), PhDs must be trained not just in research, but in skills outside of academia. However, a recent study by Sigma Xi found that 43% of post-docs received no formal professional development (PD) training and 62% wanted more training (Davis 2005; Dawson 2007). National Science Foundation Science and Technology Centers ("STCs", or "centers") are uniquely positioned to offer value-added training to students and post-docs and can play a pivotal role in their PD. In this project, we surveyed the education and diversity leadership of all active STCs in order to identify current PD topics, discover commonalities and gaps, and document the logistics and delivery methods employed. This report presents a summary of our findings. We hope these results serve as a guide to improve graduate student and post-doc PD training, and lead to program expansion and increased collaboration across the centers.

Methods. Data were solicited through a ten-question online survey (Appendix 1) administered through Qualtrics. Qualtrics is an online survey software company used by the University of Southern California. All 14 active STCs (Appendix 2) completed the survey during spring 2014 (100% response rate). Prior to administering the survey, survey questions were pre-tested by multiple centers to ensure quality control.

Survey Questions and Summary Responses. The survey was divided into two sections. Section 1 (Questions 1-3) gathered identifying information, such as name/title of respondent and name of STC. These data are summarized in the author/contributor list and in Appendix 2, and are not repeated here. Section 2 (Questions 4-10) contained content questions on professional development, with some questions having multiple parts. Summary responses to Section 2 questions are provided below, and many contain direct quotes from individual respondents.

4. *What do you think is the overall purpose/goal of providing professional development (PD) training to graduate students and post-docs?*

Most centers agreed that the main purpose of PD is to equip students and post-docs with the tools they need to be successful in today's scientific work force. PD training helps students develop the skills and strategies that translate into employable strengths. This includes teaching the student to identify the core values and strategic directions of potential employers, and determining whether or not they are a match for the student's own career goals. PD training also equips students to be mindful of quality of life issues, such as work-life balance and family leave policies, when making career decisions.

Another key goal of PD training is to promote a well-rounded scientist, one who not only conducts solid research, but can communicate their science to a variety of audiences. We believe that the future of science rests with those who can communicate with others across diverse scientific, intellectual, ethnic, socioeconomic and cultural domains.

5. *What is the size of your graduate student/postdoc cohort?*

Seven (or 50%) of STCs reported a graduate student/post-doc cohort size of <50. Six (43%) reported cohort size of 51–100. One STC (7%) reported a cohort size of >100.

6. *What specific PD training do you think would benefit graduate students and post-docs?*

All (14) or virtually all (13) centers stated that graduate students/post-docs would benefit from training in five areas: *Applying for jobs*; *Writing grants/fellowships*; *Science communication*; *Teaching*; and *Mentoring*. Eleven (79%) centers recommended training in four additional areas: *Outreach*; *Developing/designing courses*; *Ethics*; and *Work & life balance*. Just over half (8, or 57%) reported that *Lab management* training would benefit their students, and three (27%) selected *Web design*. Of the five centers that selected *Other*, all but one listed diversity (including gender research) as write-in options, indicating a strong perceived need for diversity training.

7. *Does your center provide PD opportunities to graduate students and post-docs?*

All centers reported that they provide some type of PD training to their graduate students and post-docs. The most common types of PD offerings were *Applying for jobs* (11 centers), *Outreach* (11), *Writing grants/fellowships* (10), *Science communication* (9), *Mentoring* (9) and *Ethics* (8). Fewer than half of the centers offered training in *Teaching* (6), *Developing/designing courses* (5), *Work & life balance* (5), *Diversity* (3) and *Lab management* (3). Only one center trained graduate students/post-docs on *Web design*. Two centers noted that they offer *Safety training*.

a. *Does your center require that graduate students & post-docs participate in PD?*

Out of 14 centers, only three (or 21%) required their graduate students and post-docs to fully participate in PD activities while four centers required participation at only some events. The remaining seven (50%) centers had no participatory requirements. *Ethics* training was mandatory for all four centers that required partial participation. *Safety training* and *Grant writing* were also listed as required seminars by one "partial participation" center. Another "partial participation" center required graduate students and post-docs to participate in *Ethics* training, *Science communication* and *Networking* through regular center meetings, seminar

presentations, workshops and retreats, in addition to seminars on *Grant writing*, *Lab management* and *Teaching*. This same center offered optional job placement and outreach activities.

- b. *Does your center reward graduate students & post-docs for participating in PD? If so, how?*

Eleven (79%) centers incentivized participation while three (27%) did not. Incentives ranged from certificates (2 centers) and meals (3) to travel awards (5) and stipends (3). Centers that did not offer incentives emphasized that a high quality experience was the reward.

- c. *Are faculty/principal investigators involved in providing PD training to graduate students and post-docs? If so, what is their role?*

Faculty and PIs were involved in PD activities at nine (64%) centers. Their main role was to serve as mentors and provide feedback. Their responsibilities ranged from serving as workshop presenters and panelists (5 centers) to creating content for PD activities (6). Faculty also led workshops on how to fund post-docs and how to write and review research proposals.

- d. *What mechanisms do you use to provide PD training to your graduate students and post-docs?*

The main mechanism for training graduate students and post-docs was *In person*, other than *annual meeting* (13 centers) and at each STC's *Annual meeting* (11). Nine centers used *Online methods* such as webinars and Google+, while four used *Teleconferences*. In selecting the *Other* option, one center said they provided PD training at national conferences.

8. *Does your center have a graduate student/postdoc council?*

- a. *How are council members selected?*
b. *Who do they report to?*
c. *What are their responsibilities?*

The centers were split almost evenly on this question: six centers had a council while eight did not. Methods for selecting council members included elections, peer nominations and volunteering. Students reported to either their center's Education Director or the Associate/Managing Director. Council members were expected to: serve as representatives of their center; organize social and professional development activities; gather information about what types of trainings students/post-docs want; and/or provide input to their center's leadership.

9. *Apart from any PD training that your center might provide, does your institution provide any PD to graduate students and post-docs?*

All but one center (13 or 93%) reported that their home institution provided *Ethics* training to graduate students and post-docs. Other top PD topics were: *Applying for jobs* (10 centers), *Writing grants/fellowships* (9), *Science communication* (8), *Teaching* (8) and *Mentoring* (7). A minority of centers reported that their institution provided PD training on the following subjects: *Developing/designing courses* (6), *Web design* (6), *Work & life balance* (6), *Outreach* (5) and *Lab management* (4).

10. Additional comments?

Two centers shared challenges. One center noted: *Our students are often so engaged in their research it is often hard for them to take advantage of professional development opportunities. We are doing our best to work with students in preparing them for careers after they complete their programs.* Another center communicated two challenges: 1) *Engaging students and post-docs from all partner institutions.* 2) *Developing a sense of center community among the students and post-docs. Most of the faculty knew each other well before the center was created (they go WAY back), but their students and post-docs don't. We try to address this challenge with some success by incorporating networking and team-building into PD training, and also by offering PD workshops and networking events at national conferences, which many STC participants would attend anyway.*

Conclusions & Future Work. The STC PD survey responses demonstrate that all centers are actively contributing to the professional development of their graduate students and post-docs, particularly in six key topic areas: *Applying for jobs; Outreach; Writing grants/fellowships; Science communication; Mentoring; and Ethics.* Eleven (79%) centers reported that training in *Developing/designing courses* and *Work & life balance* would benefit their students and post-docs, yet only 5 (36%) centers offer training in these two areas. Additionally, four centers noted the importance of training in *Diversity*, despite the fact that diversity wasn't listed as a training topic. These results indicate a perceived need for more STCs to train students and post-docs in three areas: *Developing/designing courses; Work & life balance; and Diversity.*

The next logical step is for centers to share their successful programs at an STC-wide level and build upon each other's programs to maximize success and avoid reinventing the wheel. We encourage centers to use the shared resources to improve and expand their programs, and to work collaboratively to develop and implement STC-wide professional development training opportunities for students and post-docs.

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Appendix 2. Active Science and Technology Centers and their Education and Diversity Leadership

Appendix 1. Survey Instrument

Introduction

This survey is designed to gather information on professional development (PD) training provided to graduate students and post-docs by NSF Science and Technology Centers. We are hoping that each Center will take the time to provide thoughtful responses. If more than one person in your Center is involved in providing PD training, please work together and submit a single survey (one survey per center).

The survey contains 10 questions and should take about 20 minutes to complete. Regarding anonymity, we will separate the identifying information from the responses. We are asking for your identifying information so we can acknowledge all contributors, track which centers responded, and clarify responses as needed. But if you prefer to respond anonymously, please feel free to do so.

If you have any questions or concerns, please contact
Stephanie Schroeder, C-DEBI Education Director, slschroe@usc.edu
Barbara Bruno, C-MORE Education Director, barb@hawaii.edu

Section 1. Identifying Information

1. Name of STC. (Only one survey per STC, please).
2. Name(s) and title(s) of everyone who helped complete this survey. (All contributors will be acknowledged.)
3. Email address(es) of all contributors

Section 2. Professional Development

4. What do you think is the overall purpose/goal of providing professional development (PD) training to graduate students and post-docs?
5. What is the size of your graduate student/postdoc cohort?
 - <25
 - 26-50
 - 51-100
 - >100
6. What specific PD training do you think would benefit graduate students and post-docs? Check all that apply, or check the "None of the above" option
 - Science Communication
 - Outreach
 - Writing grants/fellowships
 - Developing/Designing courses
 - Teaching

- Mentoring
- Ethics
- Web design
- Work and life balance
- Applying for jobs (writing CVs and cover letters, interviewing, negotiating, etc.)
- Lab management
- Other _____
- None of the above

7. Does your center provide PD opportunities to graduate students and post-docs? Check all that apply, or check the "None of the above" option

- Science Communication
- Outreach
- Writing grants/fellowships
- Developing/Designing courses
- Teaching
- Mentoring
- Ethics
- Web design
- Work and life balance
- Applying for jobs (writing CVs and cover letters, interviewing, negotiating, etc.)
- Lab management
- Other _____
- None of the above

- a. Does your center require that graduate students & post-docs participate in PD?
- b. Does your center reward graduate students & post-docs for participating in PD? If so, how? (e.g., provide stipends)
- c. Are faculty / principal investigators involved in providing PD training to graduate students and post-docs? If so, what is their role _____
- d. What mechanisms do you use to provide PD training to your graduate students and post-docs
 - *Online (webinars, google +, etc)
 - *Teleconferences
 - *In person, at annual meeting
 - *In person, other than annual meeting
 - *Other _____

8. Does your center have a graduate student/postdoc council?

- a. How are council members selected?
- b. What are their responsibilities?
- c. Who do they report to?

9. Apart from any PD training that your center might provide, does your institution provide any PD to graduate students and post-docs? Check all that apply (that you are aware of)

- Science Communication

- Outreach
- Writing grants/fellowships
- Developing/Designing courses
- Teaching
- Mentoring
- Ethics
- Web design
- Work and life balance
- Applying for jobs (writing CVs and cover letters, interviewing, negotiating, etc.)
- Lab management
- Other _____
- None of the above

10. Additional comments?

Thank you for completing this survey!

Appendix 2. Active Science and Technology Centers and their Education and Diversity Leadership

(adapted from Bruno et al., 2014)

BEACON Center for the Study of Evolution in Action (BEACON)

Judi Brown Clarke, Diversity Director
Louise Mead, Education Director

Biology with X-Ray Free Electron Lasers (BioXFEL)

Margarita L. Dubocovich, Education & Diversity Director
Anthony Hutchinson, Education & Diversity Coordinator

Center for Brains, Minds & Machines (CBMM)

Ellen Hildreth, Co-Coordinator for Education
Haym Hirsh, Co-Coordinator for Education
Mandana Sassanfar, Diversity Coordinator

Center for Coastal Margin Observation & Prediction (CMOP)

Vanessa Green, Director of Higher Education and Diversity
Nievita Bueno Watts, Director of Academic Programs

Center for Dark Energy Biosphere Investigations (C-DEBI)

Cynthia Joseph, Diversity Director
Stephanie Schroeder, Education Director

Center for Energy Efficient Electronics Science (E³S)

Sharnnia Artis, Education & Outreach Director
Jeffrey Bokor, Associate Diversity Director
Constance Chang-Hasnain, Associate Education Director
Lea Marlor, Education and Outreach Program Manager

Center for Integrated Quantum Materials (CIQM)

Tina Brower-Thomas, Education Director
Kathryn Hollar, Education Director

Center for Layered Polymeric Systems (CLiPS)

Pamela Bligh-Glover, Executive Director for Planning & Education
Risa Hartman, Director for Education & Diversity
Tryreno Sowell, Director for Education & Diversity
Dave Schiraldi, Associate Director of Education & Diversity

Center for Microbial Oceanography: Research and Education (C-MORE)

Barbara Bruno, Education Director

Center for Multiscale Modeling of Atmospheric Processes (CMMAP)

Scott Denning, Director for Education and Diversity
Melissa Burt, Education and Diversity Manager

Center for Remote Sensing of Ice Sheets (CREGIS)

Linda Hayden, Associate Director of Education
Darnell Johnson, Education Program Manager
Darryl Monteau, Education Coordinator
Cheri Hamilton, K-12 Education Outreach Coordinator

Center for Science of Information (CSoI)

Brent Ladd, Director of Education
Kelly Andronicos, Director of Diversity

Emergent Behaviors of Integrated Cellular Systems (EBICS)

Linda Griffith, Director of Education
Manu Platt, Director of Diversity
Leslie McClain, Education and Diversity Program Manager
Lakeita Servance, Educational Outreach Manager/Site Coordinator

Team for Research in Ubiquitous Secure Technology (TRUST)

Aimée Tabor, Education Director
William Robinson, Outreach Director